THE JOURNAL OF ECOLOGY

EDITED FOR THE

BRITISH ECOLOGICAL SOCIETY

BY

JOHN LEE, JAMES WHITE & JOHN ETHERINGTON

WITH THE ASSISTANCE OF PATRICIA FERGUSON

EDITORIAL BOARD

M. P. AUSTIN J. CONNOLLY M. J. CRAWLEY
M. J. HUTCHINGS R. L. JEFFERIES A. J. LACK S. P. LONG
E. VAN DER MEIJDEN J. SILVERTOWN D. A. WILLIAMS

VOLUME 77

1989

BLACKWELL SCIENTIFIC PUBLICATIONS

OXFORD LONDON EDINBURGH BOSTON MELBOURNE

1989

PUBLISHED BY BLACKWELL SCIENTIFIC PUBLICATIONS LTD, OSNEY MEAD, OXFORD

This journal is covered by *Current Contents, ASCA* and *Science Citation Index*.

© 1989 British Ecological Society. Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by The British Ecological Society for libraries and other users registered with the Copyright Clearance Centre (CCC) Transactional Reporting Service, provided that the base fee of $03.00 per copy is paid directly to CCC, 27 Congress Street, Salem, MA 10970, U.S.A. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works or for resale. Special requests should be addressed to the Editor.
0022-0477/89/$03.00.

Printed in Great Britain at The Alden Press, Oxford

CONTENTS

ORIGINAL PAPERS PAGE

Aarsen, L. W. *See* **Taylor, D. R.**
Abrecht, D. G. *See* **Lonsdale, W. M.**
Aerts, R. & Berendse, F. Above-ground nutrient turnover and net primary production of an evergreen and a deciduous species in a heathland ecosystem 343
Ågren, J. Seed size and number in *Rubus chamaemorus*: between-habitat variation, and effects of defoliation and supplemental pollination 1080
Aldon, E. F. *See* **Wisdom, C. S.**
Alliende, M. C. & Harper, J. L. Demographic studies of a dioecious tree. I. Colonization, sex and age structure of a population of *Salix cinerea* 1029
Alliende, M. C. Demographic studies of a dioecious tree. II. The distribution of leaf predation within and between trees 1048
Andersen, A. N. Impact of insect predation on ovule survivorship in *Eucalyptus baxteri* 62
Anderson, N. J. A whole-basin diatom accumulation rate for a small eutrophic lake in Northern Ireland and its ecological implications 926
Andrew, M. H. *See* **Watkinson, A. R.**
Aplet, G. H., Smith, F. W. & Laven, R. D. Stemwood biomass and production during spruce-fir stand development 70
Armstrong, W. *See* **Laan, P.**
Bastow Wilson, J. Relations between native and exotic plant guilds in the Upper Clutha, New Zealand 223
Bastow Wilson, J. *See* **Kelly, B. J.**
Battarbee, R. W. *See* **Bazely, D. R.**
Battarbee, R. W. *See* **Jones, V. J.**
Battarbee, R. W., Stevenson, A. C., Rippey, B., Fletcher, C., Natkanski, J., Wik, M. & Flower, R. J. Causes of lake acidification in Galloway, south-west Scotland: a palaeoecological evaluation of the relative roles of atmospheric contamination and catchment change for two acidified sites with non-afforested catchments 651
Bazely, D. R. & Jefferies, R. L. Leaf and shoot demography of an arctic stoloniferous grass, *Puccinellis phryganodes*, in response to grazing 811
Bazely, D. R., Stevenson, A. C., Battarbee, R. W. & Jefferies, R. L. Lesser snow geese and the nitrogen economy of a grazed salt marsh 24
Berendse, F. *See* **Aerts, R.**
Berrevoets, M. J. *See* **Laan, P.**
Best, B. J. *See* **Reader, R. J.**
Birks, H. J. B. *See* **Peglar, S. M.**
Blom, C. W. P. M. *See* **Laan, P.**
Boyer, M. L. H. & Wheeler, B. D. Vegetation patterns in spring-fed calcareous fens: calcite precipitation and constraints on fertility 597
Briske, D. D. & Butler, J. L. Density-dependent regulation of ramet populations within the bunchgrass *Schizachyrium scoparium*: interclonal versus intraclonal interference 963
Brown, V. K. *See* **Gange, A. C.**
Butler, J. L. *See* **Briske, D. D.**
van der Bijl, L., Sand-Jensen, K. & Hjermind, A. L. Photosynthesis and canopy structure of a submerged plant, *Potamogeton pectinatus*, in a Danish lowland stream 947
Callaghan, T. V., Carlsson, B. A. & Tyler, N. J. C. Historical records of climate-related growth in *Cassiope tetragona* from the arctic 823
Carlsson, B. A. *See* **Callaghan, T. V.**
Chanway, C. P., Holl, F. B. & Turkington, R. Effect of *Rhizobium leguminosarum* biovar *trifolii* genotype on specificity between *Trifolium repens* and *Lolium perenne* 1150
Chapman, S. B., Rose, R. J. & Clarke, R. T. A model of the phosphorus dynamics of *Calluna* heathland 35
Chidumayo, E. N. Early post-felling response of *Marquesia* woodland to burning in the Zambian copperbelt 430
Clarke, J. S. Effects of long-term water balances on fire regime, north-western Minnesota 989

Clarke, J. S., Merkt, J. & Müller, H. Post-glacial fire, vegetation, and human history on the northern Alpine forelands, south-western Germany 897
Clarke, R. T. *See* **Chapman, S. B.**
Copland, B. J. & Whelan, R. J. Seasonal variation in flowering intensity and pollination limitation of fruit set in four co-occurring *Banksia* species 509
Crawford, C. S. *See* **Widsom, C. S.**
Dale, M. R. T. & MacIsaac, D. A. New methods for the analysis of spatial pattern in vegetation . 78
De Steven, D. Genet and ramet demography of *Oenocarpus mapora* ssp. *mapora*, a clonal palm of Panamanian tropical moist forest 579
Douglas, D. A. Clonal growth of *Salix setchelliana* on glacial river gravel bars in Alaska 112
Duff, G. K. *See* **Proctor, J.**
Enright, N. J. & Lamont, B. B. Seed banks, fire season, safe sites and seedling recruitment in five co-occurring *Banksia* species 1111
Evans, I. M. *See* **Gange, A. C.**
Fenner, M. *See* **Lee, W.G.**
Fletcher, C. *See* **Battarbee, R. W.**
Flower, R. J. *See* **Battarbee, R. W.**
Fone, A. L. A comparative demographic study of annual and perennial *Hypochoeris* (Asteraceae) . 495
Fone, A. L. Competition in mixtures of the annual *Hypochoeris glabra* and perennial *H. radicata* . 484
Franco, A. C. & Nobel, P. S. Effect of nurse plants on the microhabitat and growth of cacti . . . 870
Fritz, S. C. Lake development and limnological response to prehistoric and historic land-use in Diss, Norfolk, U.K. 182
Fritz, S. C. *See* **Peglar, S. M.**
Gange, A. C., Brown, V. K., Evans, I. M. & Storr, A. L. Variation in the impact of insect herbivory on *Trifolium pratense* through early plant succession 537
Gimingham, C. H. *See* **Scandrett, E.**
Goldingay, R. L. *See* **Whelan, R. J.**
Grime, J. P. *See* **Rincon, E.**
Gunnarsson, K. *See* **Kairesalo, T.**
Gutman, M. *See* **Noy-Meir, I.**
Harper, J. L. *See* **Alliende, M. C.**
Heaney, A. *See* **Proctor, J.**
Heideman, M. C. Temporal and spatial variation in the phenology of flowering and fruiting in a tropical rainforest 1059
Hjermind, A. L. *See* **van der Bijl, L.**
Holl, F. B. *See* **Chanway, C. P.**
Hutchings, M. J. & Russell, P. J. The seed regeneration dynamics of an emergent saltmarsh . . . 615
Jefferies, R. L. *See* **Bazely, D. R.**
Jefferies, R. L. *See* **Jones, V. J.**
Jonasson, P. M. *See* **Kairesalo, T.**
Jones, E. W. *See* **Peterken, G. F.**
Jones, V. J., Stevenson, A. C., Battarbee, R. W. & Jefferies, R. L. Acidification of lakes in Galloway, south west Scotland: a diatom and pollen study of the post-glacial history of the round loch of Glenhead 1
Jonsson, G. S. *See* **Kairesalo, T.**
Kairesalo, T., Jonsson, G. S., Gunnarsson, K. & Jonasson, P. M. Macro- and microalgal production within a *Nitella opaca* bed in lake Thingvallavatn, Iceland 332
Kaplan, Y. *See* **Noy-Meir, I.**
Keddy, P. A. *See* **Shipley, B.**
Kelly, B. J., Bastow Wilson, J. & Mark, A. F. Causes of the species–area relation: a study of islands in Lake Manapouri, New Zealand 1021
Kelly, D. Demography of short-lived plants in chalk grassland. I. Life cycle variation in annuals and strict biennials 747
Kelly, D. Demography of short-lived plants in chalk grassland. II. Control of mortality and fecundity 770
Kelly, D. Demography of short-lived plants in chalk grassland. III. Population stability 785
Koch, M. S. & Mendelssohn, I. A. Sulphide as a soil phytotoxin: differential responses in two marsh species 565

Koike, F. Foliage-crown development and interaction in *Quercus gilva* and *Q. acuta* 92
Laan, P., Berrevoets, M. J., Lythe, S., Armstrong, W. & Blom, C. W. P. M. Root morphology and aerenchyma formation as indicators of the flood-tolerance of *Rumex* species 693
Lamont, B. B. *See* **Enright, N. J.**
Laven, R. D. *See* **Aplet, G. H.**
Law, R. *See* **Mahdi, A.**
Lee, W. G. & Fenner, M. Mineral nutrition allocation in seeds and shoots of twelve *Chionochloa* species in relation to soil fertility 704
Lemky, K. *See* **Shipley, B.**
Lonsdale, W. M. & Abrecht, D. G. Seedling mortality in *Mimosa pigra*, an invasive tropical shrub . 371
Lonsdale, W. M. *See* **Watkinson, A. R.**
Lythe, S. *See* **Laan, P.**
MacIsaac, D. A. *See* **Dale, M. R. T.**
Mahdi, A., Law, R. & Willis, A. J. Large niche overlaps among coexisting plant species in a limestone grassland community 386
Mark, A. F. *See* **Kelly, B. J.**
Markager, S. & Sand-Jensen, K. Patterns of night-time respiration in a dense phytoplankton community under a natural light regime 49
Matlack, G. R. Secondary dispersal of seed across snow in *Betula lenta*, a gap-colonizing tree species 858
Meentemeyer, V. *See* **Upadhyay, V. P.**
Mendelssohn, I. A. *See* **Koch, M. S.**
Merkt, J. *See* **Clarke, J. S.**
Moore, D. R. J. *See* **Shipley, B.**
Moser, E. B. *See* **Rebertus, A. J.**
Müller, H. *See* **Clarke, J. S.**
Natkanski, J. *See* **Battarbee, R. W.**
Nobel, P. S. *See* **Franco, A. C.**
Noy-Meir, I., Gutman, M. & Kaplan, Y. Responses of mediterranean grassland plants to grazing and protection 290
Pacala, S. W. *See* **Thrall, P. H.**
Paul, N. D. The effects of *Puccinia lagenophorae* on *Senecio vulgaris* in competition with *Euphorbia peplus* 552
Peart, D. R. Species interactions in a successional grassland. I. Seed rain and seedling recruitment . 236
Peart, D. R. Species interaction in a successional grassland. II. Colonization of vegetated sites . . 252
Peart, D. R. Species interactions in a successional grassland. III. Effects of canopy gaps, gopher mounds and grazing on colonization 267
Peglar, S. M., Fritz, S. C. & Birks, H. J. B. Vegetation and land-use history at Diss, Norfolk, U.K. 203
Peterken, G. F. & Jones, E. W. Forty years of change in Lady Park Wood: the young-growth stands 401
Phillipps, C. *See* **Proctor, J.**
Proctor, J., Phillipps, C., Duff, G. V., Heaney, A. & Robertson, F. M. Ecological studies on Gunung Silam, a small ultrabasic mountain in Sabah, Malaysia. II. Some forest processes 317
Ram, J., Singh, J. S. & Singh, S. P. Plant biomass, species diversity and net primary production in a Central Himalayan high altitude grassland 456
Reader, R. J. & Best, B. J. Variation in competition along an environmental gradient: *Hieracium floribundum* in an abandoned pasture 673
Rebertus, A. J., Williamson, G. B. & Moser, E. B. Fire-induced changes in *Quercus laevis* spatial pattern in Florida sandhills 638
Rieley, J. O. *See* **Upadhyay, V. P.**
Rincon, E. & Grime, J. P. An analysis of seasonal patterns of bryophyte growth in a natural habitat 447
Rincon, E. & Grime, J. P. Plasticity and light interception by six bryophytes of contrasted ecology . 439
Rippey, B. *See* **Battarbee, R. W.**
Robertson, F. M. *See* **Proctor, J.**
Rose, R. J. *See* **Chapman, S. B.**
Russell, P. J. *See* **Hutchings, M. J.**
Sand-Jensen, K. *See* **van der Bijl, L.**
Sand-Jensen, K. *See* **Markager, S.**
Scandrett, E. & Gimingham, C. H. Experimental investigation of bryophyte interactions on a dry heathland 838

Shipley, B., Keddy, P. A., Moore, D. R. J. & Lemky, K. Regeneration and establishment strategies of emergent macrophytes 1093
Silander, J. A. Jr. *See* **Thrall, P. H.**
Singh, J. S. *See* **Ram, J.**
Singh, J. S. *See* **Upadhyay, V. P.**
Singh, S. P. *See* **Ram, J.**
Sisson, W. B. Carbon balance of *Panicum coloratum* during drought and non-drought in the northern Chihuahuan desert 799
Smith, F. W. *See* **Aplet, G. H.**
Stamp, N. E. Seed dispersal of four sympatric grassland annual species of *Erodium* 1005
Stevenson, A. C. *See* **Battarbee, R. W.**
Stevenson, A. C. *See* **Bazely, D. R.**
Stevenson, A. C. *See* **Jones, V. J.**
Storr, A. L. *See* **Gange, A. C.**
Taylor, D. R. & Aarsen, L. W. The density dependence of replacement-series competition experiments 975
Thomas, S. C. & Weiner, J. Growth, death and size distribution change in an *Impatiens pallida* population 524
Thrall, P. H., Pacala, S. W. & Silander, J. A. Jr. Oscillatory dynamics in populations of an annual weed species *Abutilon theophrasti* 1135
Turkington, R. *See* **Chanway, C. P.**
Turkington, R. The growth, distribution and neighbour relationships of *Trifolium repens* in a permanent pasture. V. The coevolution of competitors 717
Turkington, R. The growth, distribution and neighbour relationships of *Trifolium repens* in a permanent pasture. VI. Conditioning effects of neighbours 734
Tyler, N. J. C. *See* **Callaghan, T. V.**
Upadhyay, V. P. & Singh, J. S. Patterns of nutrient immobilization and release in decomposing forest litter in Central Himalaya, India 127
Upadhyay, V. P., Singh, J. S., Meentemeyer, V. & Rieley, J. O. Dynamics and weight loss of leaf litter in Central Himalayan forests: abiotic versus litter quality influences 147
Watkinson, A. R., Lonsdale, W. M. & Andrew, M. H. Modelling of the population dynamics of an annual plant *Sorgham intrans* in the wet-dry tropics 162
Weiner, J. *See* **Thomas, S. C.**
Wheeler, B. D. *See* **Boyer, M. L. H.**
Whelan, R. J. & Goldingay, R. L. Factors affecting fruit-set in *Telopea speciosissima* (Proteaceae): the importance of pollen limitation 1123
Whelan, R. J. *See* **Copland, B. J.**
Whitmore, T. C. Changes over twenty-one years in the Kolombangara rain forests 469
Wisdom, C. S., Crawford, C. S. & Aldon, E. F. Influence of insect herbivory on photosynthetic area and reproduction in *Gutierrezia* species 685
Wik, M. *See* **Battarbee, R. W.**
Williamson, G. B. *See* **Rebertus, A. J.**
Willis, A. J. *See* **Mahdi, A.**

BIOLOGICAL FLORA OF THE BRITISH ISLES

Lobelia dortmanna L. 1161

REVIEWS

Aleksandrova, V. D. *Vegetation of the Soviet Polar Deserts* 894
Barbosa, P. & Letourneau, D. K. *Novel Aspects of Insect–Plant Interactions* 1187
Barbour, M. G. & Billings, D. W. (Eds) *North American Terrestrial Vegetation*. 890
Birks, H. H., Birks, H. J. B., Kaland, P. E. & Dagfinn, M. *The Cultural Landscape: Past, Present and Future* 1179
Bramwell, A. *Ecology in the 20th Century: A History* 895
Brown, A. H. D., Marshall, D. R., Frankel, O. H. & Williams, J. T. *The Use of Plant Genetic Resources* 1175
Bunce, R. G. H. *A Field Key for Classifying British Woodland Vegetation.* Part 2 1183
Bunker, S. G. *Underdeveloping the Amazon* 614

Chernov, Y. I. *The Living Tundra* 612
Clutton-Brock, T. H. & Albon, S. D. *Red Deer in the Highlands* 1177
Collinson, A. S. *World Vegetation* 1177
Crawford, R. M. M. *Studies in Plant Survival* 1179
Delcourt, P.A. & Delcourt, H. R. *Long Term Forest Dynamics of the Temperate Zone* 311
Ellenberg, H. *Vegetation Ecology of Central Europe* 887
Evans, M. S. (Ed.) *Toxic Contaminants and Ecosystem Health* 613
Graham, G. G. *The Flora and Vegetation of County Durham* 311
Greaves, M. P., Smith, B. D. & Grieg-Smith, P. W. (Eds) *Field Methods for the Study of Environmental Effects of Pesticides* 613
Grime, J. P., Hodgson, J. G. & Hunt, R. *Comparative Plant Ecology: A Functional Approach to Common British Plants and Communities* 892
Gummerman, G. J. *The Anasazi in a Changing Environment* 1177
Hickey, M. & King, C. *100 Families of Flowering Plants* 1181
Hughes, R. Elfyn, Dale, J., Sanderson, B., Thomson, A. G. & Lutman, J. *Vegetation and Environment of the Cliff Habitats of the Mountains of North Wales* 893
Jalas, J. & Suominen, J. (Eds) *Atlas Flora Europaea*, Vols I, II & III 1180
Jones, M. (Ed.) *Archaeology and the Flora of the British Isles* 1182
Keresztesi, B. (Ed.) *The Black Locust* 613
Küchler, A. W. & Zonneveld, I. S. *Vegetation Mapping* 1186
Mackenzie, J. J. & El-Ashry, M. T. *Ill Winds: Airborne Pollution's Toll on Tree and Crops* 889
Marchand, P. J. *Life in the Cold—an Introduction to Winter Ecology* 887
Marshall, T. J. & Holmes, J. W. *Soil Physics* 613
McRae, S. G. *Practical Pedology* 315
Mead, R. *The Design of Experiments: Statistical Principles for Practical Applications* 889
Meyers, A. A. & Giller, P. S. *Analytical Biogeography: An Integrated Approach to the Study of Animal and Plant Communities* 896
Miles, J., Schmidt, W. & van der Maarel, E. *Temporal and Spatial Patterns of Vegetation Dynamics* . 1184
Mitsch, W. J., Straskraba, M. & Jorgensen, S. E. *Wetland Modelling. Developments in Environmental Modelling, 12* 314
Nicholson, M. *The New Environmental Age* 1177
Rich, T. C. G. & Rich, M. D. B. *Plant Crib* 611
Rorison, I. H., Grime, J. P., Hunt, R., Hendry, G. A. F. & Lewis, D. H. *Frontiers of Comparative Plant Ecology* 888
Rosswall, T., Woodmansee, R. G. & Risser, P. G. *Scales and Global Change* 893
Sandgren, C. D. *Growth and Reproductive Strategies of Freshwater Phytoplankton* 1176
Snow, B. & Snow, D. *Birds and Berries* 610
Steentoft, M. *Flowering Plants in West Africa* 1178
Stolp, H. *Microbial Ecology: Organisms, Habitats, Activities* 610
Usher, M. B. & Thompson, D. B. A. *Ecological Change in the Uplands* 1178
Van der Meulen, F., Jungerius, P. D. & Visser, J. *Perspectives in Coastal Dune Management* . . . 1177
Vincent, W. F. *Microbial Ecosystems of the Antarctic* 1174
Weiner, W. R. *Models of Nature: Ecology, Conservation and Cultural Revolution in Soviety Russia* . 313
Wellburn, A. *Air Pollution and Acid Rain. The Biological Impact* 312
Werger, M. J. A. van der Aert, P. J. M., During, H. J. & Verhoeven, J. T. A. *Plant Form and Vegetation Structure* 1174
Worster, D. *The Ends of the Earth* 1185

OTHER PUBLICATIONS RECEIVED

Lobban, C. S., Chapman, D. J. & Kremer, B. P. *Experimental Phycology: a Laboratory Manual* . . 614
Burkhardt, F. & Smith, S. (Eds) *The Correspondence of Charles Darwin. Vol. 4 1847–1850* 1190
Cole, D. W. & Gessel, S. P. (Eds) *Forest Site Evaluation and Long-Term Productivity* 1190
Morris, R., Taylor, E. W., Brown, D. J. A. & Brown, J. A. (Eds) *Aquatic Toxicity and Aquatic Animals* . 1190
Ritchie, J. C. *Postglacial Vegetation of Canada* 1190
Zimmerli, von S. *Vegetation und Standort von Schwingrasen in der Schweiz* 1190